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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/720,325	11/24/2003	Ping Hsu	10113251	4317

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EXAMINER	
SARKAR, ASOK K	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 05/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/720,325	HSU, PING	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) *23-28* is/are withdrawn from consideration.

5)☒ Claim(s) *15-22* is/are allowed.

6)☒ Claim(s) _____ is/are rejected.

7)☒ Claim(s) *2-10* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I claims 1 – 22 in the reply filed on April 19, 2005 is acknowledged.

2. Claims 23 – 28 were withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Group II claims, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on April 19, 2005.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 11 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Hsiao, US 6,291,286.

Reagrding claim 1, Hsiao teaches a method of fabricating a trench device structure with a single-side buried strap, comprising the steps of:

- providing a semiconductor substrate having a deep trench therein (see Fig. 4);
- forming a buried trench capacitor in a lower portion of the deep trench (see column 3, line 65 – column 4, line 8);
- forming a collar insulating layer 52 lining an upper portion of the deep trench;

- forming a first conductive layer 54 overlying the buried trench capacitor the trench and surrounded by and lower than the collar insulating layer by a predetermined height (see Fig. 2);
- removing a portion of the collar insulating layer 52 from the deep trench to expose a portion of the semiconductor substrate (see Fig. 2);
- forming a second conductive layer 58 overlying the first conductive layer 54 in the deep trench, wherein the second conductive layer is lower than the surface of the semiconductor substrate (see Fig. 3); and
- forming the single-side buried strap region 56 in the semiconductor substrate directly contacting the second conductive layer without isolation by the collar insulating layer 52 (see Fig. 3) in descriptions between column 3, line 62 and column 5, line 42.

Regarding claim 11, Hsiao teaches the collar insulating layer is composed of tetra ethyle ortho silicate (TEOS) formed by chemical vapor deposition (CVD) in column 4, lines 35 – 38.

Regarding claim 13, Hsiao teaches the first and second conductive layers are composed of doped polysilicon in column 4, lines 30 – 35.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsiao, US 6,291,286 in view of Schrems, US 6,008,104.

Regarding claim 12, Hsiao fails to teach the thickness of the collar insulating layers.

Schrems teaches that the collar insulating layers are generally 200 – 300 Angstroms thick (column 6, line 35) for the benefit of manufacturing a trench capacitor with reduced charge leakage and increased capacitance in column 2, lines 46 – 50.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Hsiao's capacitor and build the collar insulating layers to be within 200 – 300 Angstroms thick for the benefit of manufacturing a trench capacitor with reduced charge leakage and increased capacitance as taught by Schrems in column 2, lines 46 – 50.

Regarding claim 14, Hsiao fails to teach the formation of buried strap region in the semiconductor substrate by a thermal treatment.

Schrems teaches that the formation of buried strap region in the semiconductor substrate by a thermal treatment since outdiffusion occurs under thermal treatment

(column 6, lines 20 – 25) for the benefit of manufacturing a trench capacitor with reduced charge leakage and increased capacitance in column 2, lines 46 – 50.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Hsiao's capacitor and form the buried strap region in the semiconductor substrate by a thermal treatment for the benefit of manufacturing a trench capacitor with reduced charge leakage and increased capacitance as taught by Schrems in column 2, lines 46 – 50.

Allowable Subject Matter

8. Claims 15 – 22 are allowed.

9. Claims 2 – 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for allowance and the indication of allowable subject matter:

These claims recite, inter alia, a method of fabricating a trench device structure with a single-side buried strap, comprising the steps of performing a tilt ion implantation on undoped polysilicon or amorphous silicon layer, wherein a portion of the undoped polysilicon or amorphous silicon layer in the deep trench is not implanted, selectively wet etching the undoped polysilicon or amorphous silicon layer, thereby exposing the underlying lining layer, sequentially etching the exposed lining layer and the contiguous collar insulating layer expose a portion of the semiconductor substrate

using the doped polysilicon or amorphous silicon layer as a mask, and removal of the remaining lining layer and the doped polysilicon or amorphous silicon layer. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok K. Sarkar
May 4, 2005

Primary Examiner